



## Project Summary

# Air Emissions from the Treatment of Soils Contaminated with Petroleum Fuels and Other Substances

Bart Eklund, Stephen Roe, Patrick Thompson, Adrienne Inglis, Whitney Wheelless, and William Horton

The report updates a 1992 report that summarizes available information on air emissions from the treatment of soils contaminated with fuels. Soils contaminated by leaks or spills of fuel products, such as gasoline and jet fuel, are a nationwide concern. Air emissions during remediation are a potential problem because of the volatile nature of many of the fuel components and the remediation processes themselves, which may promote or result in contaminant transfer to the vapor phase. Limited information also is included on air emissions from the treatment of soils contaminated with hazardous wastes.

The report will allow staff from state and local regulatory agencies, as well as staff from EPA regional offices, to assess the different options for cleaning up soil contaminated with fuels. Seven general remediation approaches are addressed in this report. For each approach, information is presented about the remediation process, the typical air emission species of concern and their release points, and the available air emissions data. Control technologies for each remediation approach are identified, and their reported efficiencies are summarized. Cost data are given for each remediation approach and for its associated control technologies. Emission factors and other emission estimation procedures for each remediation approach are presented along with a brief case study.

*This Project Summary was developed by the National Risk Management Research Laboratory's Air Pollution Pre-*

*vention and Control Division, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

The report updates a 1992 report that summarizes the available information on air emissions from the treatment of soils contaminated with fuels. It is intended to guide state and local air pollution control agencies in the evaluation of the air emission potential of treatment of contaminated soil and the cost-effectiveness of applicable emission control technologies. The scope was limited to the emissions of volatile organic compounds (VOCs); however, because of the limited data that were available, information was also included for the emission of other organic compounds. This additional information is primarily from the treatment of soils contaminated with hazardous wastes.

Seven general approaches for the disposal or treatment of soils contaminated with gasoline, oil, or diesel fuel were identified:

- Excavation and removal;
- Thermal desorption;
- Soil vapor extraction (SVE);
- *In-situ* biodegradation;
- *Ex-situ* (batch) biodegradation;
- Incineration; and
- Soil washing/solvent extraction/soil flushing.

Information on excavation also is included because the *ex-situ* approaches

all require that the contaminated soil be excavated and fed to the treatment unit. The fugitive emissions from the materials handling operations for *ex-situ* processes often are overlooked or ignored, but they may represent a significant fraction of the total emissions from the remediation effort.

Each general approach may include several specific options. For example, thermal desorption may be performed in portable units designed specifically for soil treatment or in rotary drum aggregate dryers that are part of asphalt plants or other industrial facilities.

Literature pertaining to the emissions of VOCs for each remediation approach was

identified and reviewed. The summarized information was organized into the same 10-part format for each approach:

- Process description;
- Identification of air emission points;
- Identification of typical air emission species of concern;
- Summary of published air emissions data;
- Identification of applicable control technologies;
- Cost data for the overall remediation approach;
- Cost data for the emission controls;
- Equations and models for estimating VOC emissions;

- Case study of the use of the remediation approach; and
- References.

Information about each remediation technology is summarized in Table 1. A variety of control devices may be employed with each of the remediation technologies. The most commonly used controls for each technology are shown in Table 2.

An uncertainty and sensitivity analysis was also performed for equations and models presented for estimating emissions. A range of emissions was predicted based on the variability of the parameters used in the equations/models. Parameters having the greatest influence on the predicted emissions were identified.

**Table 1.** Summary of Information for Remediation Technologies

<i>Remediation Technology</i>	<i>Emission Points</i>	<i>Typical Air Emission Species of Concern</i>	<i>Amount of Air Emissions Data</i>	<i>Frequency of Use of Controls</i>	<i>Comments</i>
<i>Excavation</i>	<i>Soil Surface</i>	<i>VOCs, PM</i>	<i>Very limited</i>	<i>Seldom</i>	<i>Often overlooked, Potential to be major air emission source</i>
<i>Thermal Desorption</i>	<i>Stack, Waste feed</i>	<i>VOCs, SVOCs</i>	<i>Extensive</i>	<i>Always</i>	<i>Usually performed with mobile units</i>
<i>Soil Vapor Extraction</i>	<i>Stack</i>	<i>VOCs</i>	<i>Some</i>	<i>&gt;50% of systems</i>	<i>May be converted to bio-venting after initial period</i>
<i>In-situ Bioremediation</i>	<i>Stack, Soil surface</i>	<i>VOCs, Degradation products</i>	<i>Very limited</i>	<i>Seldom (rarely needed)</i>	<i>Being used/proposed with increasing frequency</i>
<i>Ex-situ Bioremediation</i>	<i>Open tanks, Waste feed</i>	<i>VOCs, Degradation products, PM from waste feed</i>	<i>Very limited</i>	<i>Seldom</i>	
<i>Incineration</i>	<i>Stack, Waste feed</i>	<i>Metals, PM, NO<sub>x</sub>, CO, Dioxins/furans</i>	<i>Very extensive</i>	<i>Always</i>	<i>Seldom first choice for soils contaminated with fuels</i>
<i>Soil Washing</i>	<i>Process unit, Waste feed</i>	<i>VOCs</i>	<i>None</i>	<i>Not known</i>	<i>Developing technology</i>
<i>Solvent Extraction</i>	<i>Process unit, Waste feed</i>	<i>VOCs,</i>	<i>None</i>	<i>Not known</i>	<i>Developing technology</i>
<i>Soil Flushing</i>	<i>Soil surface, Water recovery</i>	<i>VOCs</i>	<i>None</i>	<i>Seldom (rarely needed)</i>	<i>Developing technology</i>

**Table 2.** Typical Control Technologies used for Remediation Technologies

<i>Emission Source</i>	<i>VOCs/SVOCs</i>	<i>Particulate Matter and Metals</i>	<i>Acid Gases</i>
<i>Materials Handling:</i>			
<i>Excavation</i>	<i>Operational Controls Foams Enclosure</i>	<i>Water Sprays</i>	<i>NA</i>
<i>Storage Piles</i>	<i>Polymer Sheeting</i>	<i>Cover Wind Screen</i>	<i>NA</i>
<i>Transport Vehicles</i>	<i>Cover Foam</i>	<i>Cover</i>	<i>NA</i>
<i>Roadways</i>	<i>NA</i>	<i>Gravel/Paving Water Sprays Water Sprays with Additives</i>	<i>NA</i>
<i>Thermal Desorption</i>	<i>Condensers Thermal Incineration Carbon Adsorption</i>	<i>Cyclone Venturi Scrubber Fabric Filter HEPA Filter</i>	<i>Wet Scrubber Dry Scrubber</i>
<i>Soil Vapor Extraction</i>	<i>Carbon Adsorption Catalytic Incineration Thermal Incineration Internal Combustion Engine</i>	<i>NA</i>	<i>NA</i>
<i>In-situ Bioremediation</i>	<i>Carbon Adsorption</i>	<i>NA</i>	<i>NA</i>
<i>Ex-situ Bioremediation</i>	<i>Carbon Adsorption</i>	<i>NA</i>	<i>NA</i>
<i>Incineration</i>	<i>NA</i>	<i>Cyclone Venturi Scrubber Ionizing Wet Scrubber Wet ESP Fabric Filter</i>	<i>Wet Scrubber Dry Scrubber</i>
<i>Soil Washing</i>	<i>Carbon Adsorption</i>	<i>NA</i>	<i>NA</i>
<i>Solvent Extraction</i>	<i>Thermal Incineration</i>	<i>NA</i>	<i>NA</i>
<i>Soil Flushing</i>	<i>Carbon Adsorption</i>	<i>NA</i>	<i>NA</i>

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*B. Eklund, P. Thompson, A. Inglis, W. Wheeless, and W. Horton are with Radian Corp., Austin, TX 78720; and S. Roe is with E. H. Pechan & Associates, Inc., Rancho Cordova, CA 95742*

**Susan A. Thorne** *is the EPA Project Officer (see below).*

*The complete report, entitled "Air Emissions from the Treatment of Soils Contaminated with Petroleum Fuels and Other Substances," (Order No. PB98-111685; Cost: \$57.00, subject to change) will be available only from:*

*National Technical Information Service*

*5285 Port Royal Road*

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*Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:*

*Air Pollution Prevention and Control Division*

*National Risk Management Research Laboratory*

*U.S. Environmental Protection Agency*

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